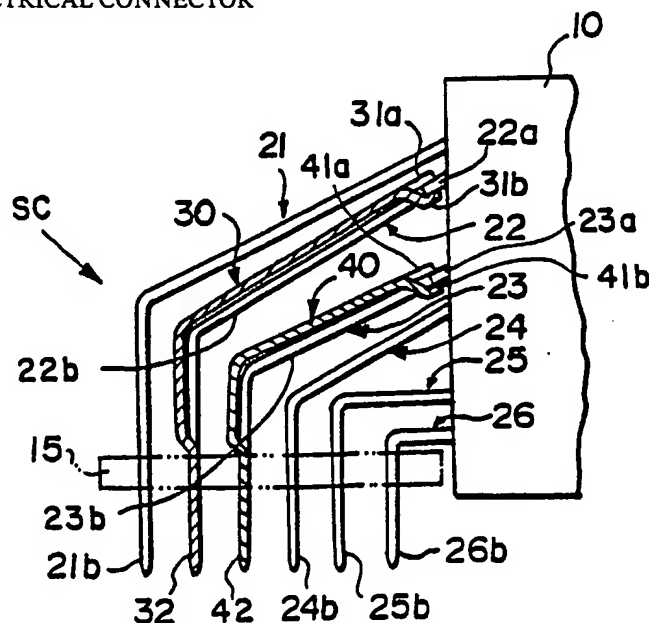




## INTERNATIONAL APPLICATION PUBLISHED UNDER THE PATENT COOPERATION TREATY (PCT)

(51) International Patent Classification <sup>4</sup> :  H01R 13/658, 23/70	A1	(11) International Publication Number: WO 87/ 07444 (43) International Publication Date: 3 December 1987 (03.12.87)
<p>(21) International Application Number: PCT/US87/00741</p> <p>(22) International Filing Date: 6 April 1987 (06.04.87)</p> <p>(31) Priority Application Number: 61-125599</p> <p>(32) Priority Date: 30 May 1986 (30.05.86)</p> <p>(33) Priority Country: JP</p> <p>(71) Applicants (for all designated States except US): AMP INCORPORATED [US/US]; P.O. Box 3608, 470 Friendship Road, Harrisburg, PA 17105 (US). NEC CORPORATION [JP/JP]; 33-1, Shiba 5-chome, Minato-ku, Tokyo (JP).</p> <p>(72) Inventors; and (75) Inventors/Applicants (for US only) : MANABE, Sakae [JP/JP]; Tama-ku, Kawasaki-shi, Kanagawa-ken (JP). KAMONO, Takashi [JP/JP]; Shinohara-cho, Kohoku-ku, Yokohama-shi, Kanagawa-ken (JP). TOKAICHI, Tetsuro [JP/JP]; UMESATO, Shoji [JP/JP]; NEC Corporation, 5-33-1, Shiba, Minato-ku, Tokyo (JP).</p>	<p>(74) Agents: SEITCHIK, Jay, L. et al.; AMP Incorporated, P.O. Box 3608, 470 Friendship Road, Harrisburg, PA 17105 (US).</p> <p>(81) Designated States: AT (European patent), BE (European patent), CH (European patent), DE (European patent), FR (European patent), GB (European patent), IT (European patent), KR, LU (European patent), NL (European patent), SE (European patent), US.</p> <p>Published With international search report. With amended claims.</p>	

(54) Title: SHIELDED ELECTRICAL CONNECTOR



## (57) Abstract

A shielded electrical connector comprises a housing (10) having contact sections of electrical contact members (21-26) disposed in passages of the housing and exposed terminal sections (21b-26b) extending outwardly and downwardly from a rear surface of the housing for electrical connection with signal paths of a printed circuit board. A shield plate (30, 40) extends along a row of terminal sections (22b, 23b) and has ground terminals (31a, 31b; 33a, 33b) electrically connected to ground tabs (22a, 23a) of contact members (22, 23) and ground terminals (32, 42) for electrical connection with ground paths of the printed circuit board.

***FOR THE PURPOSES OF INFORMATION ONLY***

Codes used to identify States party to the PCT on the front pages of pamphlets publishing international applications under the PCT.

AT	Austria	FR	France	ML	Mali
AU	Australia	GA	Gabon	MR	Mauritania
BB	Barbados	GB	United Kingdom	MW	Malawi
BE	Belgium	HU	Hungary	NL	Netherlands
BG	Bulgaria	IT	Italy	NO	Norway
BJ	Benin	JP	Japan	RO	Romania
BR	Brazil	KP	Democratic People's Republic of Korea	SD	Sudan
CF	Central African Republic	KR	Republic of Korea	SE	Sweden
CG	Congo	LI	Liechtenstein	SN	Senegal
CH	Switzerland	LK	Sri Lanka	SU	Soviet Union
CM	Cameroon	LU	Luxembourg	TD	Chad
DE	Germany, Federal Republic of	MC	Monaco	TG	Togo
DK	Denmark	MG	Madagascar	US	United States of America
FI	Finland				

-1-

SHIELDED ELECTRICAL CONNECTOR

This invention relates to an electrical connector and more particularly to a shielded electrical connector that has a shield plate disposed along exposed terminal sections of electrical contact members that extend outwardly from a housing.

Electrical connectors with a large number of electrical contacts are often used in electrical computers, particularly large computers which produce a high number of transmission signals. One example of a known connector will be described with reference to Figure 7. This connector comprises a first connector 1 which holds many plug contacts 2 in a receptacle housing 3, and a second connector 5 which also has many receptacle contacts 8 held within plug housing 6. Plug contacts 2 in the first connector 1, are disposed in multiple rows in receptacle housing 3, each row containing plug contacts 2 arrayed laterally. The plug housing 6 in the second connector 5 has multiple rows of receptacle contacts 8, corresponding to the array of plug contacts 2. When plug housing 6 is mated with receptacle housing 3, the plug contacts 2 electrically mate with corresponding receptacle contacts 8. The other end of the receptacle contacts 8 are exposed and protrude from the back of plug housing 6 and are bent downward as shown in Figure 7 as multiple rows of terminal sections 8a which are maintained in parallel rows by the retaining plate 7.

Use of this type of connector permits a high number of transmission signals using a small connector. However, because the exposed sections of the receptacle contacts 8 in the second connector 5 protrude externally from the plug housing 6, and further because the spacing between the receptacle contacts 8 has been reduced in response to a requirement to increase the number of transmission signals, crosstalk is generated between the adjoining contacts thereby resulting in the possibility of noise faults occurring. The chances of crosstalk being generated and thus the risk of noise faults, increase with the

35

-2-

higher transmission signal speeds made possible by the larger capacity and better performance of computers.

According to the present invention, a shielded electrical connector prevents the generation of crosstalk and eliminates the risk of noise faults occurring.

The shielded connector of this invention comprises rows of contact sections of contact members retained in a housing. A shield plate is covered by a layer of insulation and is positioned between the rows of exposed terminal sections of the contact members which protrude in rows from the housing. One end of this shield plate has a ground junction terminal which is electrically connected to a ground connecting portion of the contact member which is grounded. The other end of the shield plate has a terminal member to be connected to the ground plane of a printed circuit board.

A connector constructed in the manner described above prevents the occurrence of noise by intercepting the crosstalk between the rows of contact members using a grounded shield plate positioned between the exposed terminal sections of the contact members which protrude from the housing.

An embodiment according to the present invention will be described by way of example with reference to the accompanying drawings.

FIGURE 1 is an exploded perspective view of the multiple shielded connector according to the present invention showing only the second row of contact members.

FIGURE 2 is a side view partly in cross-section of the shielded connector according to the invention.

FIGURE 3 is a part side view partly in cross-section showing an enlargement of the attachment of the shield plate to the ground tabs of the contact members of the connector.

FIGURE 4 is a part perspective view of an alternative shield plate.

35

-3-

FIGURES 5 and 6 are part cross-sectional views of the shield plate attached to the ground tabs, taken in the directions indicated in Figure 4 by the lines V-V and VI-VI.

FIGURE 7 is a perspective exploded view of conventional matable electrical connector.

Figure 1 shows shielded connector SC of this invention in which only the second row of electrical contact members 22 are shown. Shield 30 as shown in Figure 2 extends along the upper surfaces of the second row of contact members 22. The dielectric housing 10 includes a plurality of contact passages (not shown) arranged in rows and opening at the front surface, indicated by the direction of arrow A, and contact sections (not shown) of the contact members 22 are accommodated in the contact passages.

In addition, many small holes 11 in multiple rows as part of the above contact passages extend through the rear surface of housing 10. The terminal sections 22b of the contact members 22 protrude through the small holes 11 at the rear surface of housing 10 in a slanted manner downwards and backwards, and are bent downwards in the middle so as to be substantially parallel to the rear surface of housing 10 for electrical connection with signal paths on a printed circuit board (not shown). However, some of the contact members 22 are grounding terminal sections so that the contact sections thereof are electrically connected to mating ground electrical contacts, and they are cut short as indicated in Figure 1 forming ground tabs 22a extending outwardly from the rear surface of housing 10 in the same angular direction as that of terminal sections 22b as well as being in alignment therewith.

Shield plate 30 comprises a metal plate which is bent to the shape of the terminal sections 22b and which has its surfaces coated with an insulating material, such as polyimide. The upper end of shield plate 30 includes pairs of first ground terminals 31a and second ground terminals 31b, in alignment with the ground tabs 22a. The bottom end of shield plate 30 has third

-4-

ground terminals 32 which protrude downwards and are in alignment with the respective pairs of ground terminals 31a and 31b. First ground terminals 31a and second ground terminals 31b are bifurcated.

5        When the shield plate 30 is placed on top of terminal sections 22b of the second row of contact members 22, the respective ground tabs 22a are disposed between bifurcated ground terminals 31a, 31b, and the ground terminals 32 are aligned with the terminal sections 22b. Ground terminals 32 are  
10        used in place of the missing terminal sections of the shortened ground tabs 22a. The ground terminals 31a, 31b and the ground terminals 32 of the shield plate 30 are not coated with insulating material.

          When the shield plate 30 is mounted on the terminal sections  
15        22b of the second row of contact members 22, and the ground tabs 22a are fitted between the first and second ground terminals 31a and 31b are soldered together, the ground tabs 22a are electrically connected with the shield plate 30. Therefore, the shield plate 30 can be grounded by connecting the ground  
20        terminals 32 to the ground path or paths of a printed circuit board (not shown), and thus crosstalk between adjacent rows of the contact members can be prevented. Also, crosstalk between adjacent contact members in each row is eliminated by grounding several contact members as shown in Figure 1.

25        The above describes the mounting of a shield plate on the second row of contact members of an electrical connector. Figure 2 shows the connector having shield plates mounted in a similar manner on two rows of the contact members. The connector has six rows of contact members 21-26 in the housing  
30        10. The terminal sections 21b-26b of each row of contact members 21-26 extend downwards and are held in place by a dielectric retaining plate 15 which prevents displacement of the terminal sections. In the connector, the shield plates 30 and 40 are respectively mounted on the upper surfaces of the second  
35        row of contact members 22 and the third row of contact members

-5-

23. The upper ends of shield plates 30,40 are electrically connected to ground tabs while ground terminals 32,42 are electrically connected to ground paths on the printed circuit board. The shield plates 30 and 40 prevent crosstalk being  
5 generated between the first and second rows of contact members 21,22 and the second and third rows of contact members 22,23 respectively.

Figure 3 shows ground tab 22a disposed between the bifurcated first and second ground terminals 31a and 31b at the  
10 upper end of shield plate 30 with ground tab 22a being soldered in place. The surface of shield plate 30 is coated with an insulating material 30a such as polyimide except for the first and second ground terminals 31a and 31b and the ground leg 32. Shield plate 40 is also connected in the same manner as shield  
15 plate 30.

Figure 4 shows a perspective view of another embodiment of a connection between shield plate 30 and ground tab 22a. In this embodiment T-shaped cuts are made in the upper end of shield plate 30 forming sections 33a,33b which are then bent  
20 downwardly as shown in Figure 5 to form arcuate ground terminal sections 33a,33b. When ground tab 22a is positioned between ground terminal sections 33a,33b and soldered thereto by solder 50, the connection is shown in Figures 5 and 6 respectively. Therefore, the insulating coating 30a on the  
25 surface of the shield plate 30 does not cover the surfaces of ground terminal sections 33a,33b to be soldered to ground tabs 22a. Thus, as shown by Figure 6, the upper surface of solder 50 should be covered with insulation tape 55. The above-described embodiments disclose the positioning of a shield  
30 plate on the upper surfaces of a row of terminal sections of electrical contact members, however other ways to position shield plates on electrical contact members are possible.

As disclosed above, this invention is such that crosstalk generated between rows of terminal sections of contact members  
35 prevent the occurrence of noise faults, through the use of a

-6-

grounded shield plate which is positioned between rows of terminal sections arrayed in rows and protruding externally from their housing.

5

10

15

20

25

30

35



-7-

CLAIMS

1. A shielded electrical connector including a plurality of contact members (21-26) each having at one end a contact section to be connected with a mating contact and at the other end a terminal section (21b-26b) to be connected to a printed circuit board, and a housing (10) accommodating therein a plurality of rows of the contact sections of the contact members, characterized in that a shield plate (30,40) coated on the exterior with an insulation layer (30a) is arranged between adjacent rows of the terminal sections which are arrayed in rows and which protrude externally from the housing, the shield plate having at one end at least a ground terminal (31a,31b; 33a,33b) to be electrically connected to the contact section (22a,23a) which is connected to a mating ground contact and at the other end a ground terminal (32,42) to be electrically connected to a ground path of the printed circuit board.

2. A shielded electrical connector as claimed in claim 1, characterized in that said ground terminal (31a,31b) comprises bifurcated terminals (31a,31b) between which contact section (22a,23a) in the form of a ground tab is disposed.

3. A shielded electrical connector as claimed in claim 1, characterized in that said ground terminal (33a,33b) comprises opposed arcuate ground terminal sections (33a,33b) between which contact sections (22a,23a) in the form of a ground tab is disposed.

4. A shielded electrical connector as claimed in claim 1, characterized in that said shield plate (30,40) extends along the row of exposed terminal sections (22b,23b).

5. A shielded electrical connector as claimed in claim 2, characterized in that said ground tab (22a,23a) is in alignment with said terminal sections (22b,23b).

6. A shielded electrical connector as claimed in claim 3, characterized in that said ground tab (22a,23a) is in alignment with said terminal sections (22b,23b).

-8-

7. A shielded electrical connector as claimed in claim 1, characterized in that said ground terminal (32,42) is in alignment with said terminal sections (22b,23b).

8. A shielded electrical connector as claimed in claim 1, characterized in that said terminal sections (21b-26b) have tapered segments extending outwardly and downwardly from a rear surface of said housing (10) and linear segments extending substantially parallel to said rear surface of said housing (10), said shield plate (30,40) has a tapered section and a linear section as it extends along the row of exposed terminal sections (22b-23b).

9. A shielded electrical connector, comprising:  
a dielectric housing (10) having rows of contact-receiving passages extending therethrough;  
electrical contact members (21-26) having contact sections disposed in said contact-receiving passages and exposed terminal sections (21b-26b) extending outwardly in rows from a rear surface of said housing for electrical engagement with signal paths of a printed circuit board;  
a shield plate (30,40) having an insulation layer (30a) covering the exterior surface of said shield plate and extending along a row of terminal sections (21b-26b);  
ground terminal contact means (31a,31b; 33a,33b) electrically connected with selected terminal sections (22a,23a);  
and  
ground terminal members (32,42) of said shield plate (30,40) are electrically connected to ground path means on the printed circuit board.

10. A shielded electrical connector as claimed in claim 9, wherein said selected terminal sections (22a,23a) are ground tabs in alignment with the respective terminal sections (22b,23b).

11. A shielded electrical connector as claimed in claim 10, wherein said ground terminal contact means (31a,31b) are bifurcated and between which said ground tabs (22A,23A) are disposed.

-9-

12. A shielded electrical connector as claimed in claim 10, wherein said ground terminal contact means (33a,33b) comprise opposed arcuate ground terminal sections between which said ground tabs (22a,23a) are disposed.

5 13. A shielded electrical connector as claimed in claim 9, wherein said terminal sections (21b-26b) are bent forming tapered portions that extend downwardly and linear portions that extend parallel to said rear surface of said housing (10).

10 14. A shielded electrical connector as claimed in claim 13, wherein said ground terminal members (32,42) are in alignment with said linear portions of said terminal sections (21b-26b).

15 15. A shielded electrical connector as claimed in claim 13, wherein said shield plate (30,40) has a tapered section and a linear section as it extends along the row of exposed terminal sections (22b,23b).

16. A shielded electrical connector as claimed in claim 9, wherein the terminal sections (21b-26b) are disposed in a retaining plate (15) holding them in place.

20

25

30

35

## AMENDED CLAIMS

[received by the International Bureau on 02 November 1987 (02.11.87);  
original claim 1 amended; other claims unchanged (1 page)]

1. A shielded electrical connector including a plurality of  
contact members (21-26) arrayed in rows, where adjacent rows  
are spaced from one another, where each row of contact members  
have at one end a contact section to be connected with a mating  
contact and at the other end a terminal section (21b-26b) to be  
connected to a printed circuit board, and a housing (10)  
accommodating therein a plurality of rows of the contact sections  
of the contact members, characterized in that a shield plate  
(30,40) coated on the exterior with an insulation layer (30a) is  
arranged between adjacent rows of the terminal sections which  
are arrayed in rows and which protrude externally from the  
housing, the said shield plate (30,40) selectively engaging the  
contact members (22,23) of a given row of such contact  
members, and having at one end thereof a ground terminal  
(31a,31b; 33a,33b) to be electrically connected to the contact  
section (22a,23a) which is connected to a mating ground contact  
and at the other end a ground terminal (32,42) to be electrically  
connected to a ground path of the printed circuit board.

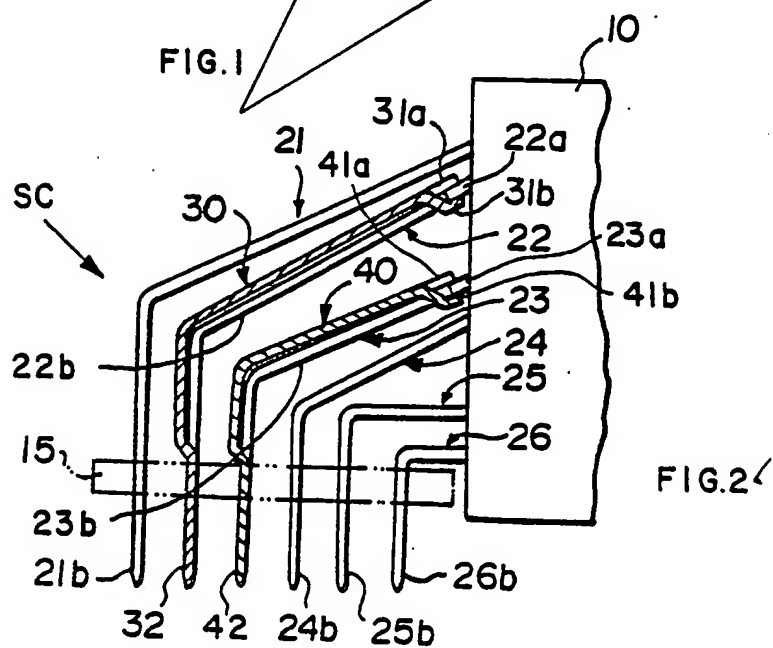
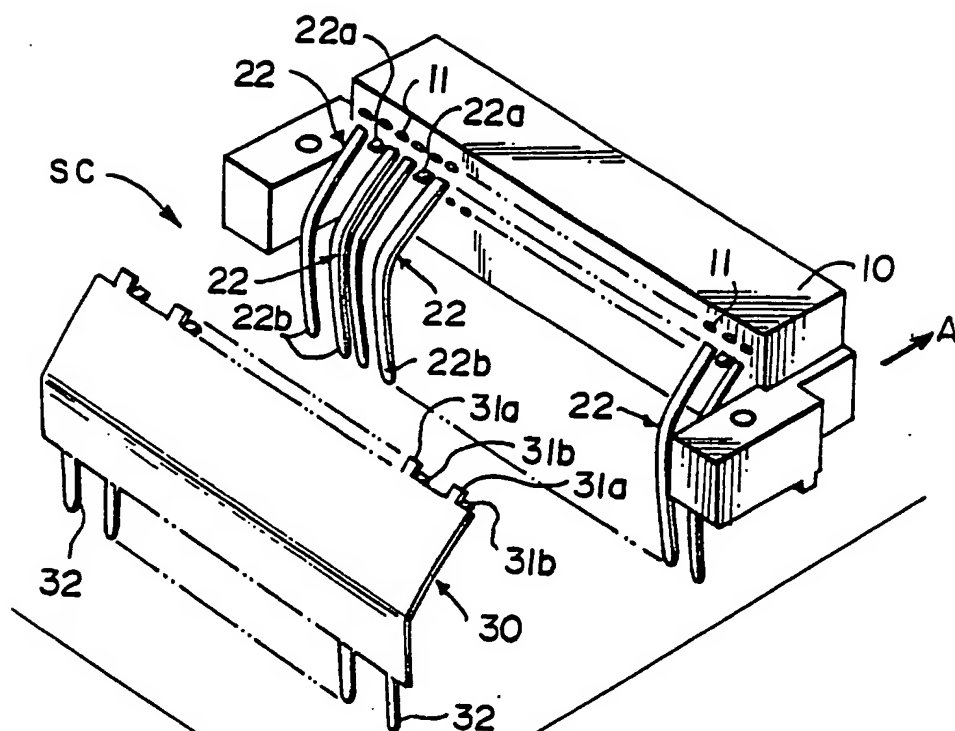
2. A shielded electrical connector as claimed in claim 1,  
characterized in that said ground terminal (31a,31b) comprises  
bifurcated terminals (31a,31b) between which contact section  
(22a,23a) in the form of a ground tab is disposed.

3. A shielded electrical connector as claimed in claim 1,  
characterized in that said ground terminal (33a,33b) comprises  
opposed arcuate ground terminal sections (33a,33b) between  
which contact sections (22a,23a) in the form of a ground tab is  
disposed.

4. A shielded electrical connector as claimed in claim 1,  
characterized in that said shield plate (30,40) extends along the  
row of exposed terminal sections (22b,23b).

5. A shielded electrical connector as claimed in claim 2,  
characterized in that said ground tab (22a,23a) is in alignment  
with said terminal sections (22b,23b);

1/3



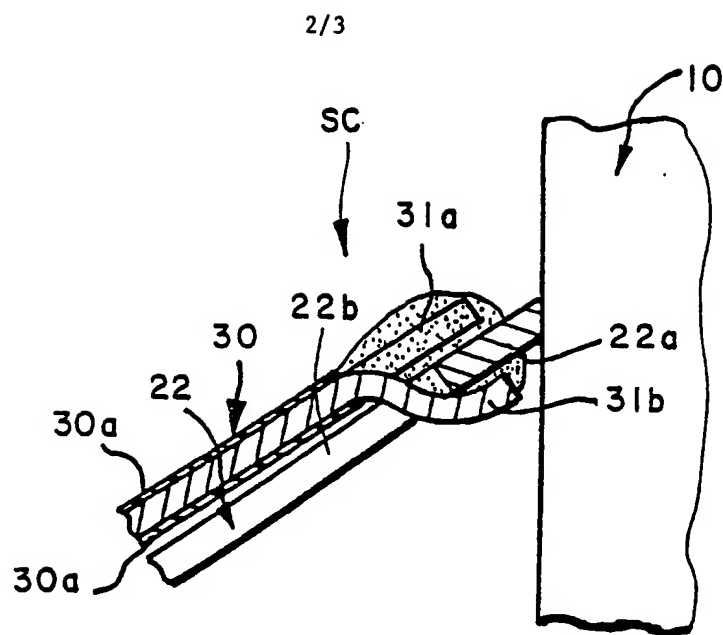


FIG. 3

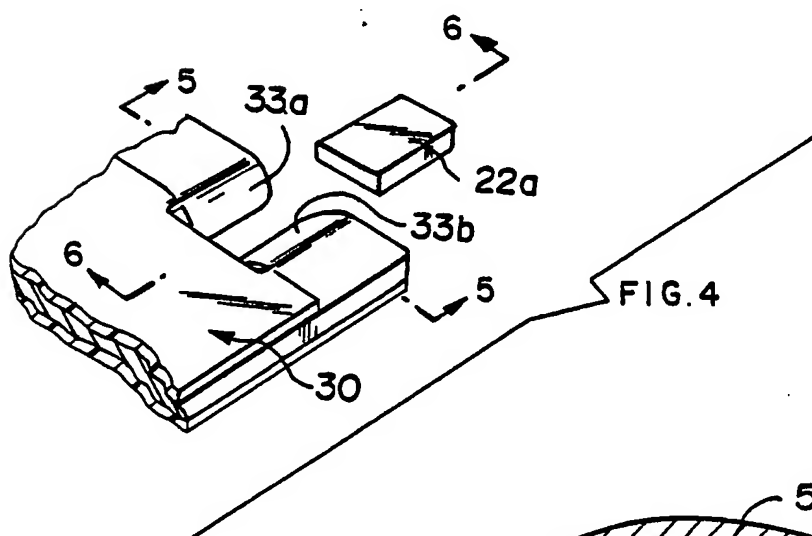


FIG. 4

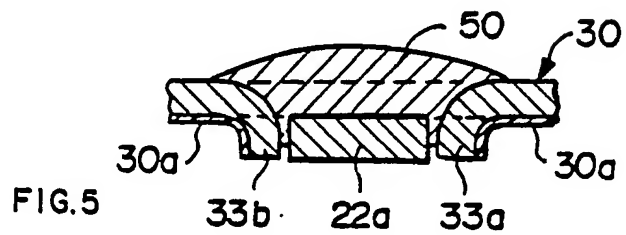
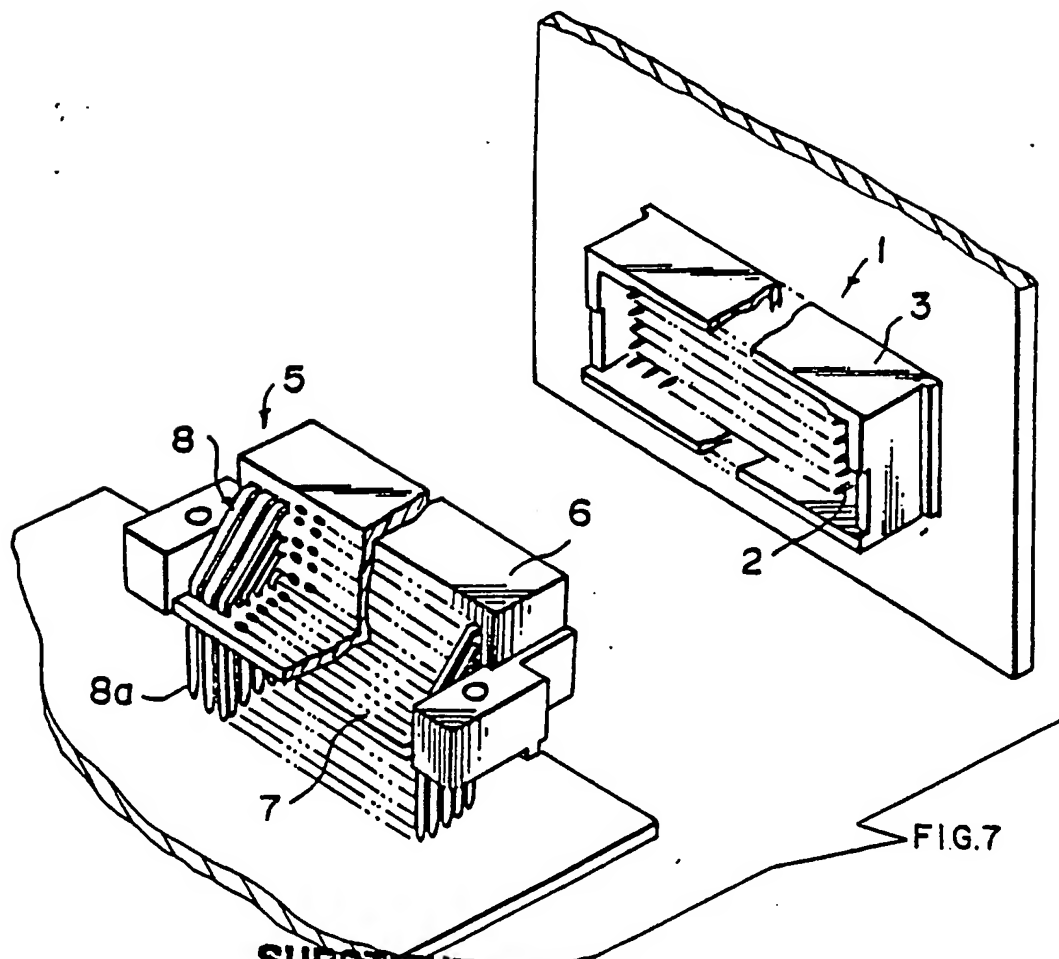
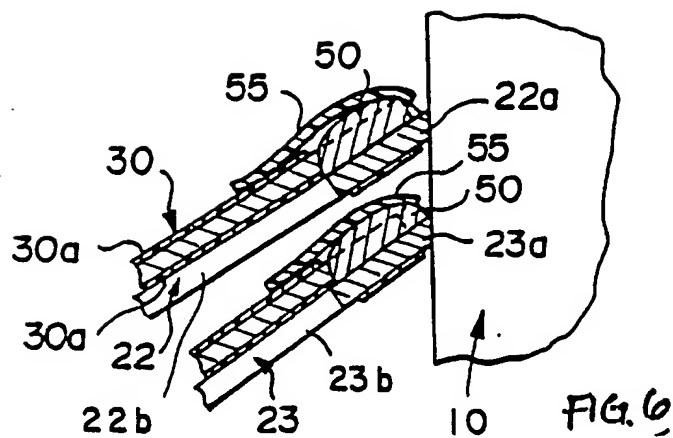


FIG. 5



SUBSTITUTE SHEET  
ISA/EP

# INTERNATIONAL SEARCH REPORT

International Application No **PCT/US 87/00741**

<b>I. CLASSIFICATION OF SUBJECT MATTER</b> (If several classification symbols apply, indicate all) * According to International Patent Classification (IPC) or to both National Classification and IPC <b>IPC<sup>4</sup>: H 01 R 13/658; H 01 R 23/70</b>		
<b>II. FIELDS SEARCHED</b>		
Minimum Documentation Searched *		
Classification System	Classification Symbols	
<b>IPC<sup>4</sup></b>	<b>H 01 R 13/00; H 01 R 9/00; H 01 R 23/00; H 01 R 17/00</b>	
Documentation Searched other than Minimum Documentation to the Extent that such Documents are Included in the Fields Searched *		
<b>III. DOCUMENTS CONSIDERED TO BE RELEVANT *</b>		
Category *	Citation of Document, ** with Indication, where appropriate, of the relevant passages <sup>12</sup>	Relevant to Claim No. <sup>13</sup>
X  A	GB, A, 2027290 (SIEMENS) 13 February 1980 see the whole document  -----	1,4,9 8,13,15
<div style="display: flex; justify-content: space-between;"> <div style="width: 45%;"> <p>* Special categories of cited documents: **</p> <p>"A" document defining the general state of the art which is not considered to be of particular relevance</p> <p>"E" earlier document but published on or after the international filing date</p> <p>"L" document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)</p> <p>"O" document referring to an oral disclosure, use, exhibition or other means</p> <p>"P" document published prior to the international filing date but later than the priority date claimed</p> </div> <div style="width: 45%;"> <p>"T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention</p> <p>"X" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step</p> <p>"Y" document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art.</p> <p>"&amp;" document member of the same patent family</p> </div> </div>		
<b>IV. CERTIFICATION</b>		
Date of the Actual Completion of the International Search	Date of Mailing of this International Search Report	
14th August 1987	16 SEP 1987	
International Searching Authority	Signature of Authorized Officer	
EUROPEAN PATENT OFFICE	<b>M. VAN MOL</b>	



ANNEX TO THE INTERNATIONAL SEARCH REPORT ON

INTERNATIONAL APPLICATION NO. PCT/US 87/00741 (SA 17225)

This Annex lists the patent family members relating to the patent documents cited in the above-mentioned international search report. The members are as contained in the European Patent Office EDP file on 28/08/87

The European Patent Office is in no way liable for these particulars which are merely given for the purpose of information.

Patent document cited in search report	Publication date	Patent family member(s)	Publication date
GB-A- 2027290	13/02/80	FR-A,B 2431782	15/02/80
		DE-A,B,C 2832243	31/01/80
		US-A- 4232929	11/11/80

For more details about this annex :  
see Official Journal of the European Patent Office, No. 12/82

**This Page is Inserted by IFW Indexing and Scanning  
Operations and is not part of the Official Record**

**BEST AVAILABLE IMAGES**

Defective images within this document are accurate representations of the original documents submitted by the applicant.

Defects in the images include but are not limited to the items checked:

- ☐ BLACK BORDERS
- ☐ IMAGE CUT OFF AT TOP, BOTTOM OR SIDES
- ☒ FADED TEXT OR DRAWING
- ☐ BLURRED OR ILLEGIBLE TEXT OR DRAWING
- ☐ SKEWED/SLANTED IMAGES
- ☐ COLOR OR BLACK AND WHITE PHOTOGRAPHS
- ☐ GRAY SCALE DOCUMENTS
- ☐ LINES OR MARKS ON ORIGINAL DOCUMENT
- ☐ REFERENCE(S) OR EXHIBIT(S) SUBMITTED ARE POOR QUALITY
- ☐ OTHER: \_\_\_\_\_

**IMAGES ARE BEST AVAILABLE COPY.**

**As rescanning these documents will not correct the image problems checked, please do not report these problems to the IFW Image Problem Mailbox.**